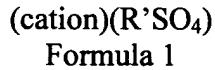


## Claims

We claim the following:

- 1) Use of a compound of the Formula 1



5 as a solvent, solvent additive, extraction solvent, heat carrier, heat carrier additive, or phase transfer catalyst, wherein:

R' is selected from the group consisting of a linear or branched, saturated or unsaturated, aliphatic or alicyclic, functionalized or non-functionalized alkyl radical with 3-36 carbon atoms, 10 wherein R' is optionally functionalized with one or more X groups; X is selected from the group consisting of an -OH, -OR'', -COOH, -COOR'', -NH<sub>2</sub>, -SO<sub>4</sub>, -F, -Cl, -Br, -I or -CN; and R'' is selected from the group consisting of a branched or linear hydrocarbon chain with 1 - 12 carbon atoms; and

the compound has melting point of less than 100° C.

- 15 2) The use of claim 1, wherein the cation is a nitrogen-containing cation selected from the group consisting of a quaternary ammonium cation, an imidazolium cation, a pyridinium cation, a pyrazolium cation, and a triazolium cation.
- 3) The use of claim 1, wherein the cation is selected from the group consisting of:
- 20 a) quaternary ammonium cation with the general formula (NR<sub>1</sub>R<sub>2</sub>R<sub>3</sub>R)<sup>+</sup>;
- b) phosphonium cation with the general formula (PR<sub>1</sub>R<sub>2</sub>R<sub>3</sub>R)<sup>+</sup>;
- c) imidazolium cation with the general formula

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in which the imidazole core is optionally substituted with at least one group selected from C<sub>1</sub>-C<sub>6</sub> alkyl group, C<sub>1</sub>-C<sub>6</sub> alkoxy group, C<sub>1</sub>-C<sub>6</sub> aminoalkyl group, C<sub>5</sub>-C<sub>12</sub> aryl group or C<sub>5</sub>-C<sub>12</sub>-25 aryl-C<sub>1</sub>-C<sub>6</sub> alkyl group;

d) pyridinium cation with the general formula

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in which the pyridine core is optionally substituted with at least one group selected from C<sub>1</sub>-C<sub>6</sub> alkyl group, C<sub>1</sub>-C<sub>6</sub> alkoxy group, C<sub>1</sub>-C<sub>6</sub> aminoalkyl group, C<sub>5</sub>-C<sub>12</sub> aryl group or C<sub>5</sub>-C<sub>12</sub>-30 aryl-C<sub>1</sub>-C<sub>6</sub> alkyl group;

e) pyrazolium cation with the general formula

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in which the pyrazole core is optionally substituted with at least one group selected from C<sub>1</sub>-C<sub>6</sub> alkyl group, C<sub>1</sub>-C<sub>6</sub> alkoxy group, C<sub>1</sub>-C<sub>6</sub> aminoalkyl group, C<sub>5</sub>-C<sub>12</sub> aryl group or C<sub>5</sub>-C<sub>12</sub>-aryl-C<sub>1</sub>-C<sub>6</sub> alkyl group; and

- 5 f) triazolium cation with the general formula

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in which the triazole core is optionally substituted with at least one group selected from C<sub>1</sub>-C<sub>6</sub> alkyl group, C<sub>1</sub>-C<sub>6</sub> alkoxy group, C<sub>1</sub>-C<sub>6</sub> aminoalkyl group, C<sub>5</sub>-C<sub>12</sub> aryl group or C<sub>5</sub>-C<sub>12</sub>-aryl-C<sub>1</sub>-C<sub>6</sub> alkyl group; wherein

- 10 g) the radicals R<sup>1</sup>, R<sup>2</sup>, R<sup>3</sup> are selected independently at each occurrence from the group consisting of:

- i) hydrogen;  
ii) linear or branched, saturated or unsaturated, aliphatic or alicyclic alkyl groups with 1 to 20 carbon atoms;

- 15 iii) heteroaryl groups, heteroaryl-C<sub>1</sub>-C<sub>6</sub> alkyl groups with 3 to 8 carbon atoms in the heteroaryl radical and at least one heteroatom selected from N, O and S which is optionally substituted with at least one group selected from C<sub>1</sub>-C<sub>6</sub> alkyl groups and/or halogen atoms;

- iv) aryl, aryl-C<sub>1</sub>-C<sub>6</sub> alkyl groups with 5 to 12 carbon atoms in the aryl radical, which is optionally substituted with at least one C<sub>1</sub>-C<sub>6</sub> alkyl group and/or a halogen atom; and

- 20 h) the radical R is selected from the group consisting of:

- i) linear or branched, saturated or unsaturated, aliphatic or alicyclic alkyl groups with 1 to 20 carbon atoms;  
ii) heteroaryl-C<sub>1</sub>-C<sub>6</sub> alkyl groups with 3 to 8 carbon atoms in the aryl radical and at least one heteroatom selected from N, O and S, which is optionally substituted with at least one C<sub>1</sub>-C<sub>6</sub> alkyl group and/or halogen atom; and  
iii) aryl-C<sub>1</sub>-C<sub>6</sub> alkyl groups with 5 to 12 carbon atoms in the aryl radical, which is optionally substituted with at least one C<sub>1</sub>-C<sub>6</sub> alkyl group and/or halogen atom.

- 25 4) The use of claim 1, wherein the anion has an empirical formula selected from the group consisting of C<sub>4</sub>H<sub>9</sub>SO<sub>4</sub>, C<sub>8</sub>H<sub>17</sub>SO<sub>4</sub> or C<sub>12</sub>H<sub>25</sub>SO<sub>4</sub>.  
30 5) The use of claim 1, wherein the compound of the Formula 1 has a melting point of less than

75 C.

- 6) The use of claim 1, wherein the compound of the Formula 1 has a melting point of less than 50 C.
- 7) The use of claim 1, wherein (R'SO<sub>4</sub>) is an alkyl sulfate ester, wherein the alkyl moiety is selected from the group consisting of butyl, octyl, 2-ethylhexyl, and dodecyl.
- 8) The use of claim 7, wherein the cation is a nitrogen containing cation selected from the group consisting of 1-ethyl-3-methylimidazolium, 1-butyl-3-methylimidazolium butyl, 1-hexyl-3-methylimidazolium, 1-octyl-3-methylimidazolium, 1-decyl-3-methylimidazolium, 1-dodecyl-3-methylimidazolium, 1-butyl-pyridinium, trimethyldecylammonium, trioctylmethylammonium, trimethyldecylammonium, and trihexyltetradecylphosphonium.
- 9) The use of claim 1, wherein the cation is a nitrogen containing cation selected from the group consisting of 1-ethyl-3-methylimidazolium, 1-butyl-3-methylimidazolium butyl, 1-hexyl-3-methylimidazolium, 1-octyl-3-methylimidazolium, 1-decyl-3-methylimidazolium, 1-dodecyl-3-methylimidazolium, 1-butyl-pyridinium, trimethyldecylammonium, trioctylmethylammonium, trimethyldecylammonium, and trihexyltetradecylphosphonium.
- 10) The use of claim 1, wherein the compound of the Formula 1 is used in a reaction catalyzed by a transition metal.
- 11) The use of claim 10, wherein the compound of the Formula 1 is used in a hydroformylation reaction, oligomerization reaction, esterification reaction, isomerization reaction or amide bond-forming reaction.
- 12) The use of claim 1, wherein the compound of the Formula 1 is used in a reaction catalyzed by an enzyme or biocatalyst.
- 13) The use of claim 12, wherein the compound of the Formula 1 is used in an oligomerization reaction, C-C bond-forming reaction, esterification reaction, isomerization reaction, or amide bond-forming reaction.
- 14) The use of claim 1, wherein the compound of the Formula 1 is substantially hydrolytically stable in neutral aqueous solution (pH = 7) up to 80 °C.
- 15) The use of claim 1, wherein the compound of the Formula 1 has a melting point of less than 25 C.
- 30 16) The use of claim 1, wherein the compound is selected from the group consisting of:
  - a) 1-ethyl-3-methylimidazolium butyl sulfate;

- b) 1-ethyl-3-methylimidazolium octyl sulfate;
- c) 1-ethyl-3-methylimidazolium 2-ethylhexyl sulfate;
- d) 1-ethyl-3-methylimidazolium dodecyl sulfate;
- e) 1-butyl-3-methylimidazolium butyl sulfate;
- 5 f) 1-butyl-3-methylimidazolium octyl sulfate;
- g) 1-butyl-3-methylimidazolium 2-ethylhexyl sulfate;
- h) 1-butyl-3-methylimidazolium dodecyl sulfate;
- i) 1-hexyl-3-methylimidazolium butyl sulfate;
- j) 1-hexyl-3-methylimidazolium octyl sulfate;
- 10 k) 1-hexyl-3-methylimidazolium 2-ethylhexyl sulfate;
- l) 1-hexyl-3-methylimidazolium dodecyl sulfate;
- m) 1-octyl-3-methylimidazolium butyl sulfate;
- n) 1-octyl-3-methylimidazolium octyl sulfate;
- o) 1-octyl-3-methylimidazolium 2-ethylhexyl sulfate;
- 15 p) 1-octyl-3-methylimidazolium dodecyl sulfate;
- q) 1-decyl-3-methylimidazolium butyl sulfate;
- r) 1-decyl-3-methylimidazolium octyl sulfate;
- s) 1-decyl-3-methylimidazolium 2-ethylhexyl sulfate;
- t) 1-decyl-3-methylimidazolium dodecyl sulfate;
- 20 u) 1-dodecyl-3-methylimidazolium butyl sulfate;
- v) 1-dodecyl-3-methylimidazolium octyl sulfate;
- w) 1-dodecyl-3-methylimidazolium 2-ethylhexyl sulfate;
- x) 1-dodecyl-3-methylimidazolium dodecyl sulfate;
- y) 1-butyl-pyridinium butyl sulfate;
- 25 z) 1-butyl-pyridinium octyl sulfate;
- aa) 1-butyl-pyridinium 2-ethylhexyl sulfate;
- bb) 1-butyl-pyridinium dodecyl sulfate;
- cc) trimethyldecylammonium butyl sulfate;
- dd) trimethyldecylammonium 2-ethylhexyl sulfate;
- ee) trioctylmethylammonium butyl sulfate;
- ff) trioctylmethylammonium octyl sulfate;

- gg) trioctylmethylammonium 2-ethylhexyl sulfate;
- hh) trioctylmethylammonium dodecyl sulfate;
- ii) trimethyldecylammonium butyl sulfate;
- jj) trimethyldecylammonium octyl sulfate;
- 5 kk) trihexyltetradecylphosphonium butyl sulfate;
- ll) trihexyltetradecylphosphonium octyl sulfate;
- mm) trihexyltetradecylphosphonium 2-ethylhexyl sulfate;
- nn) trihexyltetradecylphosphonium dodecyl sulfate.

17) Use of a compound of the Formula 1

10 (cation)(R'SO<sub>4</sub>)  
Formula 1  
as a solvent, solvent additive, extraction solvent, heat carrier, heat carrier additive, or phase transfer catalyst, wherein:

15 R' is selected from the group consisting of a linear or branched, saturated or unsaturated, aliphatic or alicyclic, functionalized or non-functionalized alkyl radical with 3-36 carbon atoms, wherein R' is optionally functionalized with one or more X groups; X is selected from the group consisting of an -OH, -OR'', -COOH, -COOR'', -NH<sub>2</sub>, -SO<sub>4</sub>, -F, -Cl, -Br, -I or -CN; and R'' is selected from the group consisting of a branched or linear hydrocarbon chain with 1 - 12 carbon atoms;

20 the compound has melting point of less than 100° C;

the cation is a nitrogen-containing cation selected from the group consisting of a quaternary ammonium cation, an imidazolium cation, a pyridinium cation, a pyrazolium cation, and a triazolium cation;

25 the compound of the Formula 1 is substantially hydrolytically stable in neutral aqueous solution (pH = 7) up to 80 °C.

18) The use of claim 17, wherein the anion has an empirical formula selected from the group consisting of C<sub>4</sub>H<sub>9</sub>SO<sub>4</sub>, C<sub>8</sub>H<sub>17</sub>SO<sub>4</sub> or C<sub>12</sub>H<sub>25</sub>SO<sub>4</sub>.

19) Use of a compound of the Formula 1

30 (cation)(R'SO<sub>4</sub>)  
Formula 1  
as a solvent, solvent additive, extraction solvent, heat carrier, heat carrier additive, or phase transfer catalyst, wherein:

- a) ( $R'SO_4$ ) is an alkyl sulfate ester, wherein the alkyl moiety is selected from the group consisting of butyl, octyl, 2-ethylhexyl, and dodecyl;
  - b) the cation is a nitrogen containing cation selected from the group consisting of 1-ethyl-3-methylimidazolium, 1-butyl-3-methylimidazolium butyl, 1-hexyl-3-methylimidazolium, 1-octyl-3-methylimidazolium, 1-decyl-3-methylimidazolium, 1-dodecyl-3-methylimidazolium, 1-butyl-pyridinium, trimethyldecylammonium, trioctylmethylammonium, trimethyldecylammonium, and trihexyltetradecylphosphonium;
  - c) the compound has melting point of less than 100° C; and
  - d) the compound of the Formula 1 is substantially hydrolytically stable in neutral aqueous solution (pH = 7) up to 80 °C.
- 20) The use of claim 19, wherein the compound of the Formula 1 is used in a reaction catalyzed by a transition metal, and the reaction is a hydroformylation reaction, oligomerization reaction, esterification reaction, isomerization reaction or amide bond-forming reaction.
- 15 21) The use of claim 19, wherein the compound of the Formula 1 is used in a reaction catalyzed by an enzyme or biocatalyst, and the reaction is an oligomerization reaction, C-C bond-forming reaction, esterification reaction, isomerization reaction, or amide bond-forming reaction.